

press method, the cooling step after the press molding involves a phenomenon that an intermediate is caused to have an undulation such as a microscopic valley and hill having a level difference of 100  $\mu\text{m}$  or greater (page 3, lines 13 to 16). This undulation can be decreased by decreasing the heat radiation distribution in the surface of the intermediate having the form of a thin plate (page 3, lines 26 to 28).

In the method of defining the surrounding edge portion of the intermediate with a mold, ... a portion in the vicinity of the surrounding edge portion of the intermediate formed is undulated (page 3, last one to page 4, line 9). When a glass in a softened state is press-molded such that no circumferential portion of a substrate blank to be formed comes in contact with a mold, and when the substrate blank has no notch portion, an efficiently produced a substrate blank results that is free of undulation and has excellent accuracy (page 4, lines 13 to 18).

For preventing the above-discussed undulation, in independent claims 1, 2, 3 and 4 now on file, no surrounding edge portion of a blank being produced comes in contact with the mold members or parts used in the press molding.

Each of the five prior art-based rejections relies upon Inoue et al (JP 63-265833) as the essential primary reference.

In the Official Action, page 2, last paragraph, the Examiner states with regard to Inoue et al reference that “the surrounding edge portion of the substrate 14 is free as shown in figure 2, since the surrounding edge does not come in contact with any mold surface or mold part and thus not having surface marks on the surrounding edge.”

Inoue et al reference refers to the figure 2 as a document that is prior art to the invention of Inoue et al. Concerning this prior art document, the Inoue et al reference, in the paragraph bridging pages 183 and 184, describes the following:<sup>1</sup>

“For obtaining a highly accurate glass molded product, the form of molding surface of a mold is required to be exactly transferred to a glass. Above all, it is important that the molding surface of the mold be in intimate contact with the glass molded article in the step of cooling after deformation is finished. As means for accomplishing this, JP-A-60-145919 [the prior art depicted in Figure 2] discloses a method in which a

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<sup>1</sup> Although not verified this translation is believed to be accurate.

space regulating member having a larger thermal expansion coefficient than the glass is used between upper and lower mold members. ...

Fig. 2 is a cross-sectional view showing a state where a lens is formed by molding a glass material according to a conventional method. 14 is the lens formed, 11 and 12 are a pair of mold members, 13 is a space regulating member, and 15 is a supporting member. The glass material is supported by the support members 15 and heated to a temperature around the softening temperature of the glass by an appropriate method, and then, the glass material is supplied between the mold members 11 and 12 and press-molded by applying pressure to the mold of 11 and 12 with a press means that is not shown. In the cooling step after deformation, all members such as the mold, a lens, etc., undergo a shrinking. In a constitution shown in Fig. 2, a material having a larger thermal expansion coefficient than the glass is used as the space regulating member 13, whereby the space regulating member shrinks to a greater extent than the glass, and the pressures from the upper mold member 11 and the lower mold member 12 are hence effectively exerted on the lens surfaces during the cooling, so that the form of the mold is highly accurately transferred to the lens surfaces."

As is clear from the above quotation, the discussion in the Inoue et al reference is directed to accurate transfer of the form of a molding surface to a lens surface. The Inoue et al reference describes nothing concerning the importance in thermal conductivity through the support member 15 for removing the undulation. The Inoue et al reference has no incentive for undulation removal as in an object of the present invention.

The prior art reference (JP-A-60-145919 which the Inoue et al reference refers to as prior art) states the following:

As described in claim 1, the constitution of the method of the present invention for achieving the above object is "a press-molding method for a highly accurate glass molded product by supporting a circumferential portion and press-molding a glass mass having at least a

surface thereof softened under heat, the method comprising causing the movement of a mold during the step of molding to be in conformity with a dimensional change based on a contracting caused by gradual cooling of a heated space regulating member that has a thermal expansion coefficient greater than the thermal expansion coefficient of a glass constituting the above glass mass and that thermally contracts in the same direction as the press direction in a contracting amount equal to, or greater than, that of the above glass mass based on the cooling of the above glass mass."

While the Figure 2 in the Inoue reference ambiguously shows such a circumferential portion, the prior art reference to the Inoue et al reference explicitly states that the circumferential portion is supported.

Further, the Inoue et al reference relates to a method for molding a glass lens or a method for producing a glass lens by compression molding. It describes nothing concerning any method for producing a substrate blank that is a thin-plate-shaped intermediate for a substrate (for an information recording medium) by direct press-molding, in which the occurrence of undulation is prevented. Naturally, the Inoue et al reference does not address any undulation problem.

In the Office Action, page 6, third paragraph, in the response to arguments the Examiner states that "element 14 is the glass blank itself and element 15 is the supporting member holding the glass blank which as explicitly shown in figure 2 does not contact the circumference of the glass blank."

In applicants' previous argument that "the outer circumference of the lens blank comes into contact with support members 14 and 15", "support members 14 and 15" is an error -- it should be "support members 15 and 15" or the support member 15<sup>2</sup>. However, in the cooling step, the element 15 (support members) is in contact with the lens material (which the examiner refers to as "glass blank" above), and in the cooling step, heat is conducted somewhere through the element 15. In figure 2, it is not clear where the support member 15 is held, so that it is difficult to determine where heat is conducted. But as the support member 15 is not floating in

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<sup>2</sup> The support member may have an annular or ring-shaped form, and in this embodiment a one-piece support member would be used.

air, it is held somewhere and the heat is conducted somewhere. This would cause the same undulation problem if the lens would have the form of a thin plate.

In contrast, in the present invention, no surrounding edge portion of the blank being processed comes in contact with the mold members or parts used in the press molding. This implies that the glass blank is in contact with only upper and lower mold members. The glass blank is not in contact even with the support member 15.

Further, the support member 15 holds the glass material at least in a portion near the circumference, which means that the support member 15 contacts some part of the circumference of the lens material or at least some portion near the circumference as shown in the figure 2. From the viewpoint of heat conductivity that would cause the undulation problem, there is not much difference between some part of the circumference and some portion near the circumference which the support members are in contact with.


For the above reasons it is respectfully submitted that the claims of this application define inventive subject matter. Reconsideration and allowance are solicited.

Should the examiner require further information, please contact the undersigned.

Respectfully submitted,

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